OBSERVATION CONCERNING THE EFFECTS OF MEDETOMIDINE-MICRODOSE ON DIAZEPAM-KETAMINE INDUCED ANESTHESIA IN DOGS

F. BETEG, A. MUSTE, N. MATES, ALINA DONISA, LAURA SCURTU, ANDREEA BOTA, A. KRUPACI

University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Faculty of Veterinary Medicine, Surgery Department, 400372,Calea Manastur No. 3-5, Cluj-Napoca, Romania
E-mail: BTG@email.ro

Summary

The study was designed to compare quality of anesthetic induction, recovery, analgesia, muscle relaxation, duration of immobilization, and ease of endotracheal intubation between diazepam-ketamine-medetomidine (DKM) and diazepam-ketamine (DK) induced anesthesia in five dogs. Diazepam (0.25 mg/kg of body weight, IV) and ketamine (5 mg/kg, IV) with or without a microdose of medetomidine (5 µg/kg, IV) were administrated to dogs. Baseline measurement of heart and respiratory rate were taken before drug administration. All measurements were repeated again five, ten, 20, and 30 minutes after drug administration. Endotracheal intubation was attempted beginning one minute after the last drug was administration. Analgesia was evaluated by tail clamp and needle prick testing.

Key words: medetomidine, microdose, induction, dogs

Intravenous administration of diazepam-ketamine (DK) hydrochloride has widespread use in clinical practice for anesthetic induction in healthy and cardiovascular compromised dogs. Anesthetic induction with DK may require repeated administration and may be prolonged with excessive chewing, delaying in this way rapid endotracheal intubation in excited dogs. DK induced anesthesia also has been used for chemical restrain in dogs(4,6).However, duration of anesthesia may be inadequate after a single dose of DK. Administration of diazepam(0.2 mg/kg of body weight, IV)and ketamine(6 mg/kg, IV) did not result in successful immobilization in some dogs and caused excitement in others (3).

Medetomidine hydrochloride is a potent α_2-adrenoceptor agonist that induces sedation, analgesia, and muscle relaxation in dogs. In dogs, reliable, profound sedation is produced by IM administration of 40 µg of medetomidine/kg. Adverse cardiovascular effects associated with this amount of medetomidine include bradycardia, second-degree block, and hypertension (5).Because medetomidine is a potente sedative with adverse cardivascular effects, a relatively small amount, or microdose of medetomidine (5µg/kg) may minimize these effects (1,6).Addition of microdose of medetomidine may improve the quality of anesthetic induction and endotraheal intubation and extend duration of immobilization compared with DK administration alone (4).

Therefore, the purpose of this study was to compare the anesthetic and cardiorespiratory effects diazepam-ketamine-medetomidine (DKM) with diazepam-ketamine(DK) induced anesthesia in dogs.

Materials and methods

The study was performed on five healthy dogs presented for minimal invasive surgical procedure (wounds suture, skin growth removal), in the Surgical Clinic of the Faculty of Veterinary Medicine Cluj-Napoca. Before anesthetic procedures in all dogs in the study heart rate (HR), respiratory rate (RR) was measured, and body temperature was determinate by rectal checking. A 5.1 –cm, 20-gauge catheter was placed in the cephalic vein for drugs administration. To alleviate the pain associated with catheter placement, skin over dorsal cephalic vein was infiltrated with a 1% solution of lidocaine hydrochloride.

After baseline measurement, dogs received diazepam (0.25 mg/kg, IV), ketamine (5 mg/kg, IV), and medetomidine (5 µg/kg, IV; DKM-group dogs) (1,3). Anesthetic were administrated individually in the following sequence: diazepam, ketamine, medetomidine. All three drugs, delivered one at a time, were administrated within 180 seconds. Cardiorespiratory variables including HR and RR were measured 5, 10, 20, and 30 minutes after last drug administration. Eye position and rectal temperature were recorded at each time interval. All dogs continued to breath air from room after anesthetic induction (6).

Induction, anesthesia, and dog recovery quality of DK and DKM-group dogs were also evaluated on a scale of 1 to 3. Additional variables recorded included duration of lateral recumbency, analgesia, and endotracheal intubation. Analgesia and intubation were recorded as positive (achieved) or negative (not achieved). Eye position was recorded as central, slightly ventral, or ventral. All qualitative measurements were performed after measurement of cardiorespiratory variables (2, 6).

Depth of analgesia was monitored by applying pressure with a 5-cm Backhaus towel clamp around the tail. The calmp was kept locked in place for 15 seconds or until a gross movement was elicited. The clamp produces a blunt, squeezing, noxious stimulus without penetrating the skin with the sharp tips. The area of the tail was clipped before the first measurement of analgesia. Depth of analgesia was also tested by use a injection needle 20G. Skin covering the hindquarters, abdomen, shoulder, and neck areas was pricked with the needle. Muscle fasciculation, limb withdrawal, or head moving was considered as a lack of anesthesia (negative result)

Endotracheal intubation was performed beginning one minute after the last drug was administered. If intubated, the endotracheal tube was removed. If there was a thigh jaw tone, chewing motions or excessive licking during intubation, the procedure was aborted.

Results and discussions

After administration of anesthetic, HR and RR significantly decreased from baseline values in DKM-group dogs; by 30 minutes after administration these variables returned to baseline values. In DK-group dogs RR did not was change significantly from baseline values, although HR was significantly increased from baseline values after anesthetic administration.

After drug administration HR was significantly lower in DKM-group dogs, compared with DK-group dogs. The highest HR was 240beats/min at 10 minutes after administration of DK alone. The lowest HR was 50beats/min at 20 minutes after DKM administration. RR was significantly lower in DKM-group dogs compared wit DK-group dogs at 5,10,20 minutes after anesthetics(3,4).Rectal temperature remained within reference range values, but decreased similarly over time in both groups, more obviously in the DKM-group.

All dogs assumed lateral recumbency within two minutes after anesthetic drugs administration. Anesthesia induction was smooth in all DKM-group dogs. As a result of inconsistent endotracheal intubation, induction was not so smooth in DK-group compared with DKM-group dogs. Endotracheal intubation could not be achieved in two dogs administrated DK alone, because they had excessive jaw tone and excessive chewing motions. The rest of three dogs from DK-group dogs were intubated, had tight jaw tone and strong coughing, accompanied by gagging against the endotracheal tube. Endotracheal intubation was easily achieved with minimal coughing and swallowing against the endotracheal tube in all five dogs from DKM-group.

Quality of anesthesia was superior in DKM-group dogs compared with DK-group dogs. Excessive salivation, head shaking, body tremor, were commonly observed in DK-group dogs (4).One DK-group dog vocalized and defecated, and another one did not maintain lateral recumbency and attempted to stand. These signs were not observed in any dogs from DKM-group. Duration of lateral recumbency was significantly longer in DKM-group dogs compared with DK-group (5).

In DKM-group dogs, eye position rotated ventrally but returned to a central position as depth of anesthesia decreased. In contrast, eye position was always central in DK-group dogs. Time from head lifting to sternal positioning and time from head lifting to walking with minimal ataxia was not significantly different between the dogs groups. Time from induction to walking with minimal ataxia was significantly longer for DKM-group dogs. Recovery qualities were similar in both groups (7).

Changes observed in DKM-group dogs were attributed to decreased RR indicate that the microdose of medetomidine potentiated respiratory depression caused by DK (3). Results of others studies indicates that RR significantly decreased from baseline values after DK administration in dogs. Microdose of medetomidine potentiated respiratory depression of DK induced anesthesia

associated with severe hypoxemia. Because severe hypoxemia can occur during DKM treated dogs oxygen insufflations is strongly recommended to prevent potential hypoxemia when this combination of anesthetic is used. In addition, because some veterinarian will intubate the dogs after administration of DKM is also recommended assisted or controlled ventilation to be used during the first few minutes of anesthesia(5).

Heart rate significantly increased from baseline values and tachycardia (240beats/min) was observed in 3 dogs with DK induced anesthesia. The increase in HR may be attributed to general CNS awakening or excitation (6).

Severe bradycardia (30-40beats/min) which is typically associated with high amounts of medetomidine (20-40µg/kg) did not develop in the dogs of this study. The lowest HR recorded after DKM induced anesthesia was 50 beats/min. This may be the net cardiovascular effects between development of bradycardia associated with medetomidine and tachycardia associated with diazepam and ketamine (7).

Diazepam and ketamine are widely used in dogs by small animals' veterinarians as an alternative to anesthetic induction with thiobarbiturates, propofol, and methohexital. In a study six of seven Greyhounds that were given diazepam (0.28 mg/kg, IV) and ketamine (5.5 mg/kg, IV), could not be intubate, despite a smooth transition to unconsciousness status (2,4). They required an additional one fourth of the original amount of diazepam and ketamine to be administrated before endotracheal intubation to achieve. Similarly in the present study, two from five DK-group dogs could not be intubated, and strong coughing and gagging reflexes were observed in the remaining DK-group that were successfully intubated. Medetomidine administration after DK causes sedation, muscles relaxation and analgesia in dogs. In the study presented here, administration of microdose (5µg/kg) of medetomidine after DK significantly improved the quality of anesthetic induction and extended the duration of endotracheal intubation, analgesia, and lateral recumbency compared with DK alone. Improved induction quality was indicated by a rapid and smooth transition from consciousness, with an extended period of easy intubation (5).

Recovery qualities were similar in both treatment groups.

Conclusions

Administration of a microdose of medetomidine provides a useful adjunct to diazepam-ketamine induced anesthesia in dogs.

Medetomidine improve quality of anesthetic induction, ease of endotracheal intubation, and extended duration of analgesia and lateral recumbency in anesthetized dogs.

The addition of a microdose of medetomidine to DK causes sedation, muscles relaxation and analgesia in dogs.

A microdose of medetomidine, when used with DK, also extended the duration of analgesia, indicate that this combination is not only an alternative for anesthetic induction but is also suitable for short duration of immobilization for non-invasive and slightly invasive surgical procedures in dogs.

References

1. **Cullen, L.K.**, Medetomidine sedation in dogs and cats: a review of its pharmacology, antagonism and dose, Br Vet J, 1996, 152, 519-533.
2. **Hellyer, P.W., Freeman, L.C., Hubble, J.A.E.**, Induction of anesthesia with diazepam-ketamine and midazolam-ketamine in Greyhounds, Vet Surg 1991, 20, 143-147.
3. **Kolata, R.J.**, Induction of anesthesia using intravenous diazepam/ketamine in dogs, Canine Pract., 1996, 13, 8-10.
4. **Oana, L., Timen, A., Beteg, F.**, Anesteziologie □i propedeutică chirurgicală veterinară, Ed. Risoprint, 2008.
5. **Short, C.E.**, Medetomidine: a new α_2-adrenergic medication for sedation and analgesia in samll-animal practice, Vet Med, 1996, 1-11.
6. **Thurmon, J.C., Tranquili, W., Benson, G.J.,** Veterinary anesthesia 3rd Ed., Williams & Wilkins, 1996.
7. **Vaha-Vahe, A.T.**, Clinical evaluation of medetomidine, a novel sedative and analgesic drug for dogs and cats, Acta Vet Scand, 1989, 30, 267-273.